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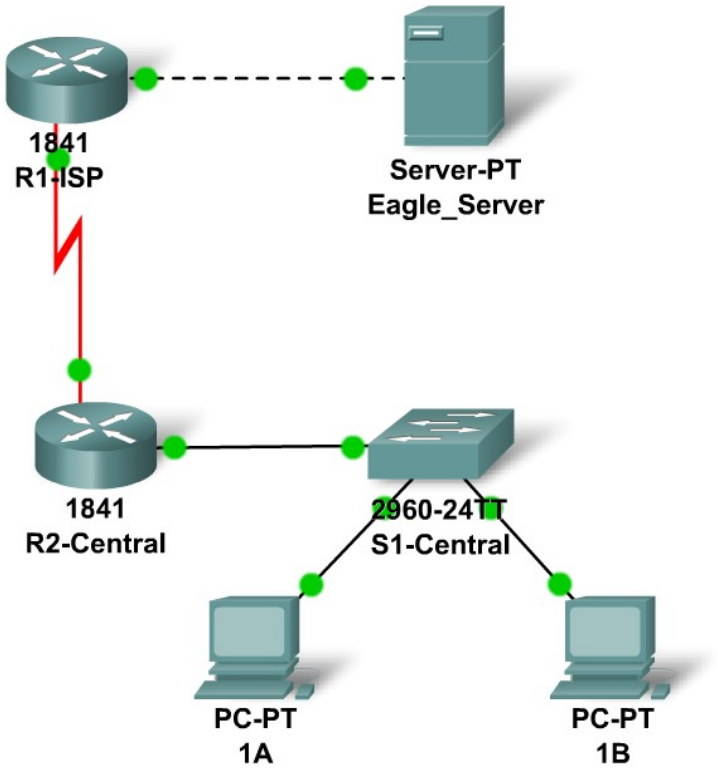
CCNA Exploration 4.0.4.0

Network Fundamentals

Student Packet Tracer Lab Manual

1.7.1: Skills Integration Challenge-Introduction to Packet Tracer

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0	192.168.254.253	255.255.255.0	N/A
	S0/0/0	10.10.10.6	255.255.255.252	N/A
R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Explore Packet Tracer Real-time mode
- Explore the Logical Workspace
- Explore Packet Tracer operation
- Connect devices
- Examine a device configuration
- Review the standard lab setup
- Overview of the devices

Background

Throughout the course you will be using a standard lab setup created from actual PCs, servers, routers, and switches to learn networking concepts. This method provides widest range of features and the most realistic experience. Since equipment and time are limited, this experience can be supplemented by a simulated environment. The simulator that is used in this course is Packet Tracer. Packet Tracer provides a rich set of protocols, equipment, and features but only a fraction of what is possible with real equipment. Packet Tracer is a supplement to not a replacement for experience with real equipment. You are encouraged to compare the results obtained from Packet Tracer network models with the behavior of real equipment. You are also encouraged to examine the Help files built into Packet Tracer, which include an extensive "My First PT Lab", tutorials, and information on the strengths and limitations of using Packet Tracer to model networks.

This activity will provide an opportunity to explore the standard lab setup using Packet Tracer simulator. Packet Tracer has two file formats it can create: .pkt files (network simulation model files) and .pka files (activity files for practice). When you create your own networks in Packet Tracer, or modify existing files from your instructor or your peers, you will often use the .pkt file format. When you launched this activity from the curriculum, these instructions appeared. They are the result of the .pka, Packet Tracer activity file format. At the bottom of these instructions are two buttons: **Check Results** (which gives you feedback on how much of the activity you have completed) and **Reset Activity** (which starts the activity over, if you want to clear your work or gain more practice).

Task 1: Explore the PT Interface.

Step 1: Examine the Logical Workplace.

When Packet Tracer starts it presents a logical view of the network in real-time mode. The main part of the PT interface is the **Logical Workplace**. This is the large area where devices are placed and connected.

Step 2: Symbols Navigation.

The lower left portion of the PT interface, below the yellow bar, is the portion of the interface that you use to select and place devices into the logical workplace. The first box in the lower left contains symbols that represent groups of devices. As you move the mouse pointer over these symbols the name of the group appears in the text box in the center. When you click on one of these symbols the specific devices in the group appear in the box to the right. As you point to the specific devices, a description of the device appears in the text box below the specific devices. Click on each of the groups and study the various devices that are available and their symbols.

Task 2: Explore PT operations

Step 1: Connect the devices using auto connect.

Click on the connections group symbol. The specific connection symbols provide different cable types that can be used to connect devices. The first specific type, the gold lightning bolt, will automatically select the connection type based on the interfaces available on the devices. When you click on this symbol the pointer resembles a cable connector.
To connect two devices click the auto connection symbol, click the first device, and then click the second device. Using the auto connection symbol, make the following connection:

- Connect the Eagle Server to the R1-ISP router.
- Connect PC-PT 1A to the S1-Central switch.

Step 2: Examine device configuration with a mouse over.

Move your mouse over the devices found in the logical workplace. As you move the mouse pointer over these symbols the device configurations appears in a text box.

- A **router** will display port configuration information including IP address, port status, and MAC address.
- A **server** will display IP address, MAC address, and Gateway information
- A **switch** will display port configuration information including IP address, MAC address, port status, and VLAN membership.
- A **PC** will display IP address, MAC address, and Gateway information.

Step 3: Examine device configuration.

Left mouse click on each device type found in the logical workplace to view the device configuration.

- **Router and Switch devices** contain three tabs. These tabs are Physical, Config, and CLI (Command Line Interface).
  - The Physical tab displays the physical components of the device such as modules. New modules can also be added using this tab.
  - The Config tab displays the general configuration information such as device name.
  - The CLI tab allows the user to configure the device using the command line interface.
- **Server and Hub devices** contain two tabs. These tabs are Physical and Config.
  - The Physical tab displays components of the device such as ports. New modules can also be added using this tab.
  - The Config tab displays the general information such as device name.
- **PC devices** contain three tabs. These tabs are Physical, Config, and Desktop.
  - The Physical tab displays components of the device. New modules can also be added using this tab.
  - The Config tab displays the device name, IP address, subnet mask, DNS, and gateway information.
  - The Desktop tab allows the user to configure, IP address, subnet mask, default gateway, DNS server, dial-up, and wireless. A terminal emulator, the command prompt and a simulated web browser can also be accessed using the Desktop tab.

Task 3: Review the Standard Lab Setup.

Step 1: Overview of the devices.

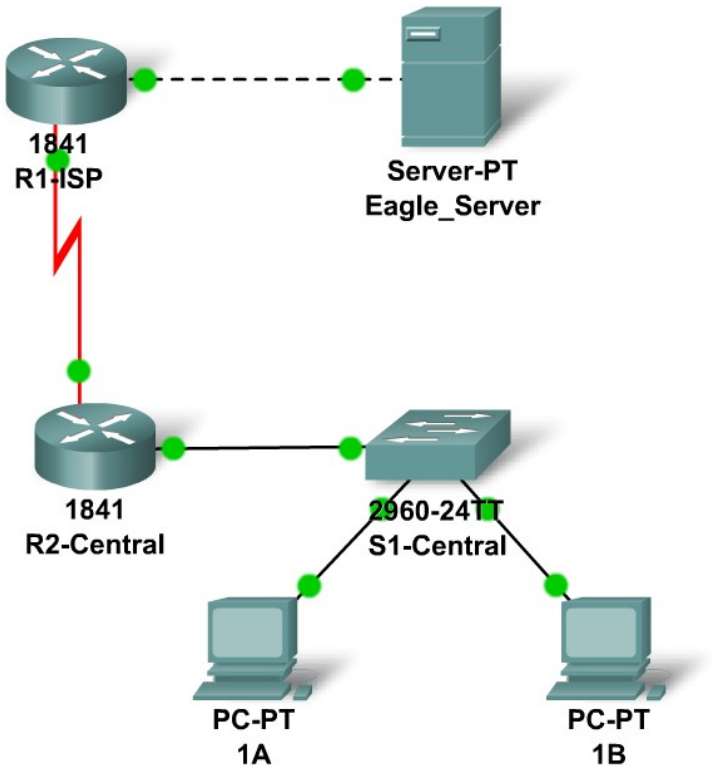
The standard lab setup will consist of two routers, one switch, one server, and two PCs. Each of these devices will be pre-configured with such information as device names, IP addresses, gateways, and connections.

Reflection:

You are encouraged to obtain Packet Tracer from your instructor and complete My First PT Lab.

2.7.1: Skills Integration Challenge-Examining Packets

Topology Diagram



Addressing Table

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R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Complete the Topology
- Add Simple PDUs in Realtime Mode
- Analyze PDUs in Simulation Mode
- Experiment with the model of the standard lab setup

Background

Throughout the course you will be using a standard lab setup created from actual PCs, servers, routers, and switches to learn networking concepts. In this activity you will continue learning how to build and analyze this standard lab topology. If you have not done so already, you are encouraged to examine the Help files available from the Help Pull-down menu at the top of the Packet Tracer GUI. Resources include an "My First PT Lab" to help you learn the basic operation of Packet Tracer, tutorials to guide you through various tasks, and information on the strengths and limitations of using Packet Tracer to model networks.

This activity will provide an opportunity to explore the standard lab setup using Packet Tracer simulator. Packet Tracer has two file formats it can create: .pkt files (network simulation model files) and .pka files (activity files for practice). When you create your own networks in Packet Tracer, or modify existing files from your instructor or your peers, you will often use the .pkt file format. When you launched this activity from the curriculum, these instructions appeared. They are the result of the .pka, Packet Tracer activity file format. At the bottom of these instructions are two buttons: Check Results (which gives you feedback on how much of the activity you have completed) and Reset Activity (which starts the activity over, if you want to clear your work or gain more practice).

Task 1: Complete the Topology.

Add a PC to the workspace. Configure it the following parameters: IP Address 172.16.1.2, Subnet Mask 255.255.0.0, Default Gateway 172.16.255.254, DNS Server 192.168.254.254, Display Name "1B" (do not include the quotation marks). Connect PC 1B to the Fa0/2 port of the S1-Central Switch and check your work with the **Check Results** button to see that the topology is complete.

Task 2: Add Simple PDUs in Realtime Mode.

Using the Add Simple PDU, send a test message: one between PC 1B and Eagle Server. Note that this packet will appear in the event list as something that was "detected" or "sniffed" on the network, and in the lower right as a user created PDU that can be manipulated for testing purposes.

Task 3: Analyze PDUs in Simulation Mode (Packet Tracing).

Switch to simulation mode. Double click on the red "Fire" button in the User Created PDU window. Use the **Capture / Forward** button to move the packet through the network. Click on the packet envelope, or on the colored square in the Info column of the Event List, to examine the packet at each step in its journey.

Task 4: Experiment with the Model of the Standard Lab Setup.

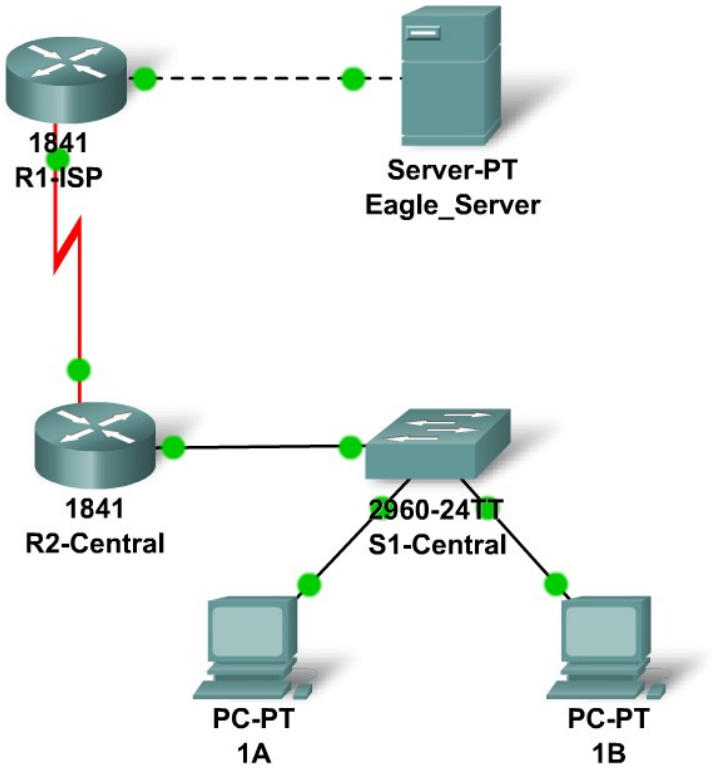
The standard lab setup will consist of two routers, one switch, one server, and two PCs. Each of these devices are pre-configured. Try creating different combinations of test packets and analyzing their journey through the network.

Reflection

If you have not already done so, you are encouraged to obtain Packet Tracer from your instructor and complete My First PT Lab (available by using the HELP Pulldown Menu and choosing CONTENTS).

3.5.1: Skills Integration Challenge-Configuring Hosts and Services

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
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R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Configure Hosts and Services
- Add, configure, and connect hosts and servers
- Explore How DNS and HTTP Work Together
- Use simulation mode to view the details of packets generated by DNS and HTTP

Background

Throughout the course you will be using a standard lab setup created from actual PCs, servers, routers, and switches to learn networking concepts. At the end of each chapter, you will build increasingly larger parts of this topology in Packet Tracer.

Task 1: "Repair" and Test the Topology.

Add a PC with a display name of 1B to the topology. Configure it with the following settings: IP Address 172.16.1.2, Subnet Mask 255.255.0.0, Default Gateway 172.16.255.254, and DNS Server 192.168.254.254. Connect PC 1B to the Fa0/2 port of the S1-Central switch.

Connect the Eagle Server to the Fa0/0 port on the R1-ISP router. Turn on web services on the server by enabling HTTP. Enable DNS services and add a DNS entry that associates "eagle-server.example.com" (without quotes) with the IP address of the server. Verify your work using feedback from the **Check Results** button and the **Assessment Items** tab. Test connectivity, in realtime, by using ADD SIMPLE PDU to test connectivity between PC 1B and the Eagle Server.

Note that when you add a simple PDU, it appears in the PDU List Window as part of "Scenario 0". The first time you issue this one-shot ping message, it will show as **Failed**--this is because of the ARP process which will be explained later. Double clicking the "Fire" button in the PDU List Window, send this single test ping a second time. This time it will be successful. In Packet Tracer, the term "scenario" means a specific configuration of one or more test packets. You can create different test packet scenarios by using the **New** button--for example Scenario 0 might have one test packet from PC 1B to Eagle Server; Scenario 1 might have test packets between PC 1A and the routers; and so on. You can remove all test packets in a particular scenario by using the **Delete** button. For example, if you use the **Delete** button for Scenario 0 the test packet you just created between PC 1B and Eagle Server will be removed--please do this prior to the next task.

Task 2: Explore How DNS and HTTP Work Together.

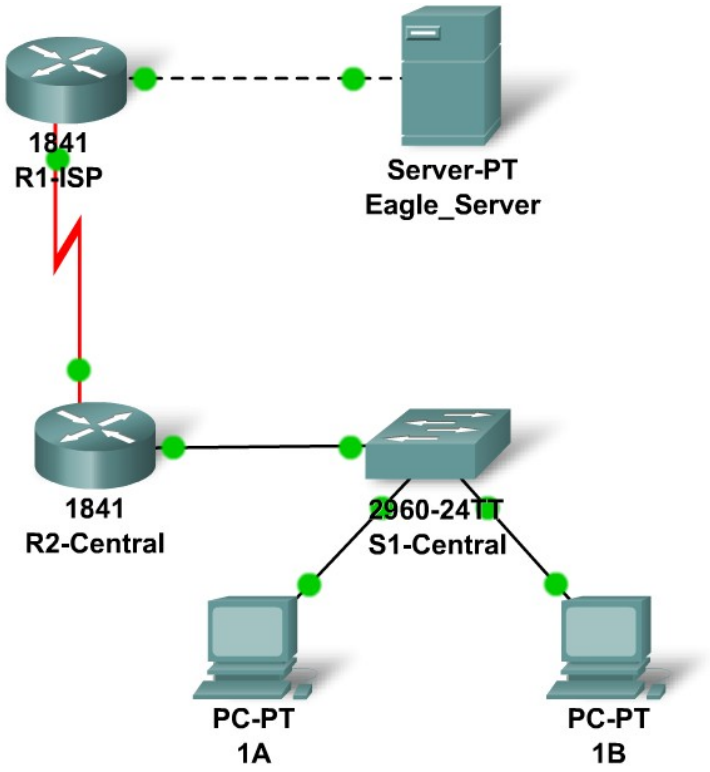
Switch from Realtime to Simulation mode. Open a web browser from the desktop of PC 1B. Type in eagle-server.example.com, press Enter, and then use the **Capture / Forward** button in the **Event List** to capture the interaction of DNS and HTTP. Play this animation and examine the Packet contents (**PDU Information** Window, **Inbound PDU Details, Outbound PDU Details**) for each event in the event list, especially when the packets are at PC 1B or at the Eagle Server. If you receive a "Buffer Full" message, click the **View Previous Events** button. While the processing of the packets by the switch and the routers may not make sense to you yet, you should be able to see how DNS and HTTP work together.

Reflection

Can you now explain the process that occurs when you type a URL into a browser and a web page returns? What types of client-server interactions are involved?
If you have not already done so, you are encouraged to obtain Packet Tracer from your instructor and complete My First PT Lab (choose the HELP Pulldown Menu, choose CONTENTS).

4.6.1: Skills Integration Challenge-Analyzing the Application and Transport Layers

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0	192.168.254.253	255.255.255.0	N/A
	S0/0/0	10.10.10.6	255.255.255.252	N/A
R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Configure Hosts and Services
- Connect and configure hosts and services on the model of the lab network
- Explore How DNS, UDP, HTTP, and UDP Work Together
- Use simulation mode to visualize the operation of DNS, UDP, HTTP, and TCP on the model of the lab network.

Background

Throughout the course you will be using a standard lab setup created from actual PCs, servers, routers, and switches to learn networking concepts. At the end of each chapter, you will build increasingly larger parts of this topology in Packet Tracer, and analyze increasingly more complex protocol interactions.

Task 1: Repair and Test the Topology.

The server has been replaced. It must be powered on. Then configure it with the following settings: IP Address 192.168.254.254, Subnet Mask 255.255.255.0, Default Gateway 192.168.254.253, DNS enabled, with the association of eagle-server.example.com with the server's IP address, HTTP enabled. Connect the Eagle Server to the Fa0/0 port on the R1-ISP router using a crossover cable.

PC 1A has lost its IP address information. Configure it with the following settings: IP Address 172.16.1.1, Subnet Mask 255.255.0.0, Default Gateway 172.16.255.254, and DNS Server 192.168.254.254. Connect PC 1A to the Fa0/1 port of the S1-Central switch using a straight-through cable.

Verify your work using feedback from the **Check Results** button and the **Assessment Items** tab. Test connectivity, in realtime, by using ADD SIMPLE PDU to test connectivity between PC 1A and the Eagle Server.

Note that when you add a simple PDU, it appears in the PDU List Window as part of "Scenario 0". The first time you issue this one-shot ping message, it will show as **Failed**--this is because of the ARP process which will be explained later. Double clicking the "Fire" button in the PDU List Window, send this single test ping a second time. This time it will be successful. In Packet Tracer, the term "scenario" means a specific configuration of one or more test packets. You can create different test packet scenarios by using the **New** button--for example Scenario 0 might have one test packet from PC 1A to Eagle Server; Scenario 1 might have test packets between PC 1B and the routers; and so on. You can remove all test packets in a particular scenario by using the **Delete** button. For example, if you use the **Delete** button for Scenario 0 the test packet you just created between PC 1A and Eagle Server will be removed--please do this prior to the next task.

Task 2: Explore How DNS, UDP, HTTP, and TCP Work Together

Switch from Realtime to Simulation Mode. Make sure Event Filter is set to display DNS, UDP, HTTP, TCP, and ICMP. Open a web browser from the desktop of 1A. Type in the URL eagle-server.example.com, press Enter, and then use the **Capture / Forward** button in the **Event List** to capture the interaction of DNS, UDP, HTTP and TCP.

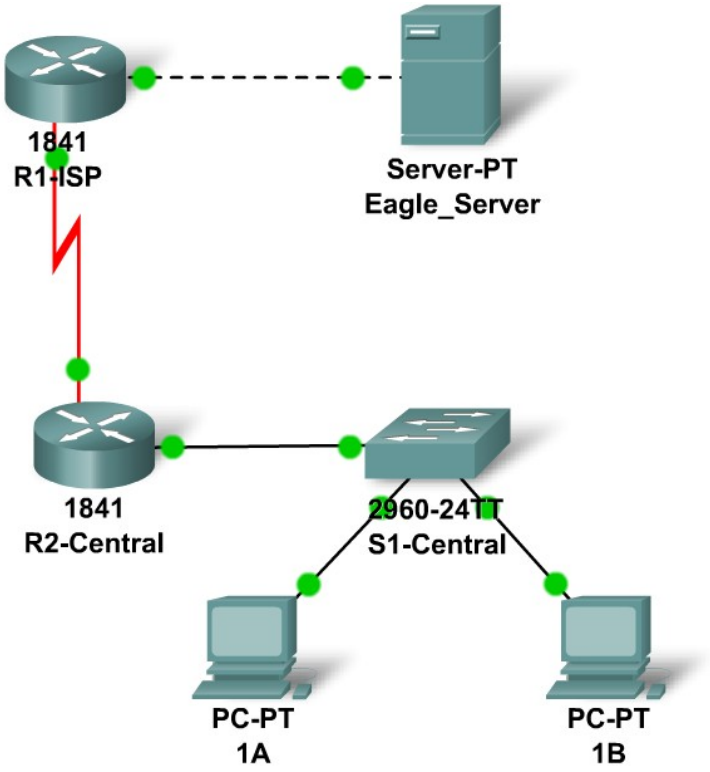
You can examine the packet in two ways: by clicking on the packet envelope as it is displayed in the animation, or by clicking on the **Info** column for that packet instance as it is listed in the **Event List**. Play this animation and examine the Packet contents (**PDU Information** Window, **Inbound PDU Details, Outbound PDU Details**) for each event in the event list, especially when the packets are at PC 1A or at the Eagle Server. If you receive a "Buffer Full" message, click the **View Previous Events** button. While the processing of the packets at the switch and the routers may not make sense to you yet, you should be able to see how DNS, UDP, HTTP, and TCP work together by studying tracing the packets and using the PDU Information window to look "inside" them.

Reflection

Can you make a diagram of the sequence of protocol events involved in requesting a web page using a URL? Where might things go wrong? Compare and contrast DNS and HTTP, and UDP and TCP.

5.6.1: Skills Integration Challenge-Routing IP Packets

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0	192.168.254.253	255.255.255.0	N/A
	S0/0/0	10.10.10.6	255.255.255.252	N/A
R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Configure a router interface using a GUI
- Explore a routing table
- Configure a static route using a GUI
- Explore the routing of IP packets

Background

Throughout the course you will be using a standard lab setup created from actual PCs, servers, routers, and switches to learn networking concepts. At the end of each chapter, you will build increasingly larger parts of this topology in Packet Tracer, and analyze increasingly more complex protocol interactions. You have already studied a variety of application protocols, such as DNS, HTTP, TFTP, DHCP, and Telnet, and two transport layer protocols, TCP and UDP. You may have noticed that regardless of what application and transport protocols were involved, in **Inbound** and **Outbound PDU Details** view they were always encapsulated in IP Packets. In this activity we will examine how the Internet Protocol, the dominant network layer protocol of the Internet, works in the context of a simple example of IP routing.

Task 1: Configure a Router Interface.

There are problems on the local area network: PC 1A cannot reach the Eagle Server (verify this in Realtime mode). It appears there is a problem with the router. Mouse over the R2-Central router, and note the condition of the Fa0/0 interface (to which switch is connected. This interface must have an IP address, subnet mask, and be turned on in order to act as the default gateway for the LAN. Click on router R2-Central, and go to the **Config** tab. At the end of the course, you will learn how to use the Cisco Internetwork Operating System (IOS) command line interface (CLI) to perform this task. For now, the **Config** tab is easier and will allow you to focus on the basic idea of IP routing. In the list shown, find **INTERFACE, FastEthernet0/0**. Add the IP address 172.16.255.254 with subnet mask of 255.255.0.0, and turn the port on. Close the router window. Verify that the router interface (port) is now working by using the mouse over. Try reaching Eagle Server. The request still fails. What are some possible reasons why?

Task 2: Examining Routes.

Use the **Inspect Tool** (magnifying glass) to examine the routing table of R2-Central. You will see the router's directly connected networks, but there is no way to reach the Eagle Server network.

Task 3: Configure a Route Using a GUI.

Click on router R2-Central and go to the **Config** tab. In the list shown find **ROUTING, Static**. Configure what is known as a default static route, using the address 0.0.0.0, mask 0.0.0.0, and the next hop of 10.10.10.6 (the S0/0/0 interface on the R1-ISP router) and click the **Add** button. This route is configured so that wherever packets from the 172.16.0.0 /16 LAN are destined, they will go to the R1-ISP router. Under **GLOBAL, Settings**, click on the **Save** button to save the interface and route configuration you have just done to NVRAM in case the router is power cycled. Use the **Inspect Tool** (magnifying glass) to examine the routing table of R2-Central again. You should now see the route you configured in the routing table.

Verify your work using feedback from the **Check Results** button and the **Assessment Items** tab. Test connectivity, in Realtime, by using ADD SIMPLE PDU to test connectivity between PC 1A and the Eagle Server. The PDU, a one-shot ping, will appear in the User Created PDU List for

future use as well. The first ping attempt will fail because the ARP tables are not populated; double click on **Fire** to send it again - this should be successful.

Task 4: Examine the Routing of the IP Packet.

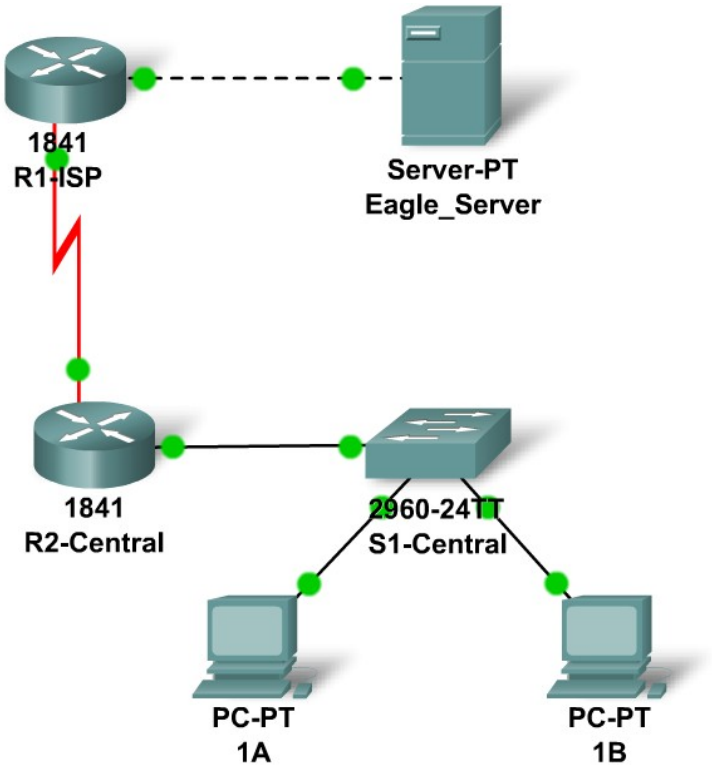
Switch to Simulation mode. Using the PDU you created in Task 3, trace the packet's journey from PC 1A to Eagle Server and back using the **Capture / Forward** button and examining the packet's contents by either clicking on the envelope or clicking on the colored square in the **Info** column of the **Event List**.

Reflection

What data can an IP Packet contain? What is meant by the phrase "the IP packet is routed"? What is a route? Where might things go wrong?

6.8.1: Skills Integration Challenge-Planning Subnets and Configuring IP Addresses

Topology Diagram



Addressing Table

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R1-ISP	Fa0/0			N/A
	S0/0/0			N/A
R2-Central	Fa0/0			N/A
	S0/0/0			N/A
PC 1A	NIC			
PC 1B	NIC			
Eagle Server	NIC			

Learning Objectives

- IP Subnet Planning
  - Practice your subnetting skills.
- Build the Network.
  - Connect devices with Ethernet and serial cables.
- Configure the network.
  - Apply your subnetting scheme to server, PCs, and router interfaces; configure services and static routing.
- Test the network.
  - Using ping, trace, web traffic, **Inspect** tool

Background

You have been asked to implement the standard lab topology, but with a new IP addressing scheme. You will use many of the skills you have learned to this point in the course.

Task 1: IP Subnet Planning

You have been given an IP address block of 192.168.23.0 /24. You must provide for existing networks as well as future growth.

Subnet assignments are:

- 1st subnet, existing student LAN (off of router R2-Central), up to 60 hosts;
- 2nd subnet, future student LAN, up to 28 hosts;
- 3rd subnet, existing ISP LAN, up to 12 hosts;
- 4th subnet, future ISP LAN, up to 6 hosts;
- 5th subnet, existing WAN, point-to-point link;
- 6th subnet, future WAN, point-to-point link;
- 7th subnet, future WAN, point-to-point link.

Interface IP addresses:

- For the server, configure the second highest usable IP address on the existing ISP LAN subnet.
- For R1-ISP's Fa0/0 interface, configure the highest usable IP address on the existing ISP LAN subnet.
- For R1-ISP's S0/0/0 interface, configure the highest usable address on the existing WAN subnet.
- For R2-Central's S0/0/0 interface, use the lowest usable address on the existing WAN subnet.
- For R2-Central's Fa0/0 interface, use the highest usable address on the existing student LAN subnet.
- For hosts 1A and 1B, use the first 2 IP addresses (two lowest usable addresses) on the existing student LAN subnet.

Additional configurations:

- For PCs 1A and 1B, in addition to IP configuration, configure them to use DNS services.
- For the server, enable DNS services, use the domain name eagle-server.example.com, and enable HTTP services.
- For R1-ISP router serial interface, you will need to set the clock rate (a timing mechanism required on the DCE end of serial links) to 64000.
- No clock rate is needed on the DTE side, in this case R2-Central's serial interface.

Task 2: Finish Building the Network in Packet Tracer.

Add cables where missing.

- Connect a serial DCE cable to R1-ISP S0/0/0, with the other end to R2-Central S0/0/0.
- Connect PC 1A to the first FastEthernet port on switch S1-Central.
- Connect PC 1B to the second FastEthernet port on switch S1-Central.
- Connect interface Fa0/0 on router R2-Central to the highest FastEthernet port on switch S1-Central.
- For all devices, make sure the power is on to the device and the interfaces.

Task 3: Configure the Network.

You will need to configure the server, both routers, and the two PCs. You will not need to configure the switch nor do you need the IOS CLI to configure the routers. Part of the router configuration has already been done for you: all you must do is configure the static routes and the interfaces via the GUI; use 64000 as the clock rate on the serial link. The static route on R1-ISP should point to the existing student LAN subnet via R2-Central's serial interface IP address; the static route on R2-Central should be a default static route which points via R1-ISP's serial interface IP address. These procedures were explained in the Chapter 5 Skills Integration Challenge.

Task 4: Test the Network.

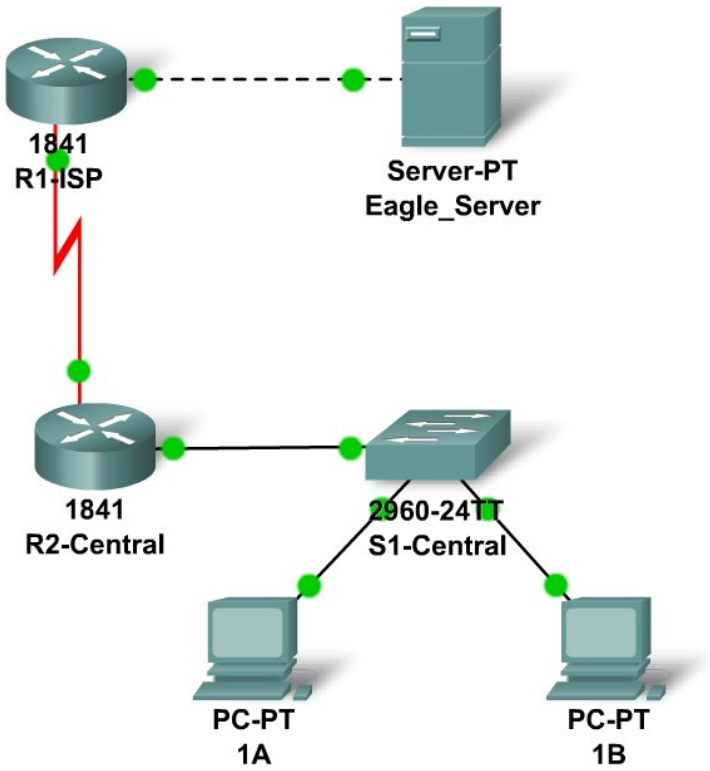
Use ping, trace, web traffic, and the **Inspect** tool. Trace packet flow in simulation mode, with HTTP, DNS, TCP, UDP, and ICMP viewable, to test your understanding of how the network is operating.

Reflection

Reflect upon how much you have learned so far! Practicing IP subnetting skills and networking building, configuration and testing skills will serve you well throughout your networking courses.

7.6.1: Skills Integration Challenge-Data Link Layer Issues

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0			N/A
	S0/0/0			N/A
R2-Central	Fa0/0			N/A
	S0/0/0			N/A
PC 1A	NIC			
PC 1B	NIC			
Eagle Server	NIC			

Learning Objectives

- IP subnet planning
  - Practice your subnetting skills.
- Build the network.
  - Connect devices with Ethernet and serial cables.
- Configure the network.
  - Apply your subnetting scheme to server, PCs, and router interfaces; configure services and static routing.
- Test the network
  - Using ping, trace, web traffic, **Inspect** tool.

Background

Network Interface Cards (NICs) are sometimes thought of as Layer 2 and Layer 1 devices (or as Layer 2 and Layer 1 components of devices that function at all 7 layers). Sometimes the network interface card for a serial connection, typically used in WAN connections, is called a WAN interface card or WIC. In this challenge you must add a WIC to a device to complete the network. In addition, you have been asked to implement a new IP addressing scheme to the Exploration lab topology.

Task 1: IP Subnet Planning.

You have been given an IP address block of 172.16.0.0 /22. You must provide for existing networks as well as future growth.

Subnet assignments are:

- 1st subnet, existing student LAN, up to 400 hosts; (Fa0/0 on R2-Central)
- 2nd subnet, future student LAN, up to 180 hosts; (not yet implemented)
- 3rd subnet, existing ISP LAN, up to 40 hosts; (Fa0/0 on R1-ISP)
- 4th subnet, future ISP LAN, up to 18 hosts; (not yet implemented)
- 5th subnet, existing WAN, point-to-point link; (S0/0/0 on R1-ISP and R2-Central)
- 6th subnet, future WAN, point-to-point link; (not yet implemented)
- 7th subnet, future WAN, point-to-point link. (not yet implemented)

Interface IP addresses:

- For the server, configure the second highest usable IP address on the ISP LAN subnet.
- For R1-ISP's Fa0/0 interface, configure the highest usable IP address on the ISP LAN subnet.
- For R1-ISP's S0/0/0 interface, configure the highest usable address on the existing WAN subnet.
- For R2-Central's S0/0/0 interface, use the lowest usable address on the existing WAN subnet.
- For R2-Central's Fa0/0 interface, use the highest usable address on the existing student LAN subnet.
- For PCs 1A and 1B, use the first 2 IP addresses (two lowest usable addresses) on the existing student LAN subnet.

Additional configurations:

- For PCs 1A and 1B, in addition to IP configuration, configure them to use DNS services.
- For the server, enable DNS services, use the domain name eagle-server.example.com, and enable HTTP services.

Task 2: Finish Building the Network in Packet Tracer, Attending to Some Layer 2 Issues.

On the R2-Central router, a network interface card is missing for the serial connection to R1-ISP: add a WIC-2T in the right hand slot. Also, on R2-Central, the Fa0/0 is shutdown; turn it on. Connect a serial DCE cable to R1-ISP S0/0/0, with the other end to R2-Central S0/0/0. For all devices, make sure the power is on to all device and interfaces.

Task 3: Configure the Network.

You will need to configure the server, both routers, and the two PCs. You will not need to configure the switch nor do you need the IOS CLI to configure the routers. Part of the router configuration has already been done for you: all you must do is configure the static routes and the interfaces via the GUI. The static route on R1-ISP should point to the existing student LAN subnet via R2-Central's serial interface IP address; the static route on R2-Central should be a default static route which points via R1-ISP's serial interface IP address. These procedures were explained in the Chapter 5 Skills Integration Challenge and practiced in the Chapter 6 Skills Integration Challenge.

Task 4: Test the Network.

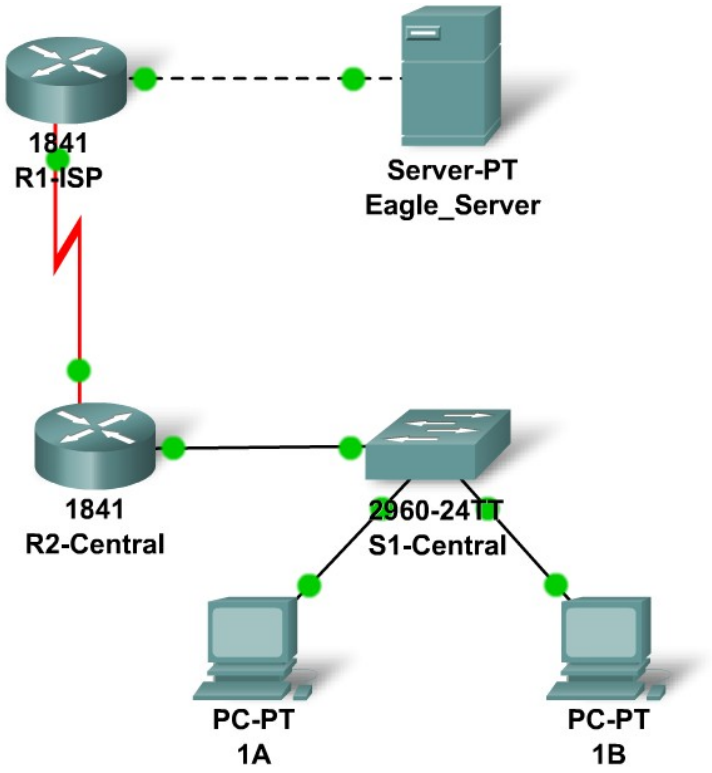
Use ping, trace, web traffic, and the **Inspect** tool. Trace packet flow in simulation mode, with HTTP, DNS, TCP, UDP, and ICMP viewable, to test your understanding of how the network is operating. Note in particular what Layer 2 encapsulation is used in each step of a packet's journey, and how the headers on the Layer 2 PDUs change.

Reflection

Consider an ICMP echo request packet sent from PC 1A to Eagle Server and the ICMP echo reply packet that results. What addresses stay the same in this situation, and what addresses change?

8.5.1: Skills Integration Challenge-Connecting Devices and Exploring the Physical View

Topology Diagram:



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0	192.168.254.253	255.255.255.0	N/A
	S0/0/0	10.10.10.6	255.255.255.252	N/A
R2-Central	Fa0/0	172.16.255.254	255.255.0.0	N/A
	S0/0/0	10.10.10.5	255.255.255.252	N/A
S1-Central	VLAN 1	172.16.254.1	255.255.0.0	172.16.255.254
PC 1A	NIC	172.16.1.1	255.255.0.0	172.16.255.254
PC 1B	NIC	172.16.1.2	255.255.0.0	172.16.255.254
Eagle Server	NIC	192.168.254.254	255.255.255.0	192.168.254.253

Learning Objectives

- Connect the devices in the standard lab setup
  - Connect the devices
  - Verify connectivity
- View the standard lab setup in the Physical Workspace
  - Enter and view the Physical Workspace
  - View the standard lab setup at the various levels of the Physical Workspace

Introduction

When working in Packet Tracer, in a lab environment, or in a corporate setting it is important to know how to select the proper cable and how to properly connect devices. This activity will examine device configurations in Packet Tracer, select the proper cable based on the configuration, and connect the devices. This activity will also explore the physical view of the network in Packet Tracer.

Task 1: Connect the Devices in the Standard Lab Setup.

Step 1: Connect the devices.

Connect PC 1A to the first port on switch S1-Central and PC 1B to the second port on switch S1-Central using the proper cable.

Click on router R2-Central and examine the configuration using the **Config** tab. Connect the proper interface on the router to Interface FastEthernet0/24 on switch S1-Central using the proper cable.

Click on both routers and examine the configuration using the **Config** tab. Connect the routers together using the proper interfaces and the proper cable

Click on router R1-ISP and examine the configuration using the **Config** tab. Connect the proper interface on the router to the proper interface on Eagle Server using the proper cable.

Step 2: Verify connectivity.

From the **Command Prompt** on the **Desktop** of both PCs issue the command **ping 192.168.254.254**, the IP address of Eagle Server. If the pings fail, check your connections and troubleshoot until the pings succeeds. Check your configuration by clicking the **Check Results** button.

Task 2: View the Standard Lab Setup in the Physical Workspace.

Step 1: Enter and view the Physical Workspace.

Most of our work in Packet Tracer has been done in the Logical Workspace. In an internetwork, routers maybe in different sites from across the street to across the globe. The serial link between the routers represents a dedicated leased line between two locations consisting of a DTE (Data Terminal Equipment), such as a router, connected to a DCE (Data Communication Equipment), such as a CSU/DSU or modem. The DCE connects to a service provider's local loop and the connections are repeated at the other end of the link. The Physical Workspace allows us to see these relationships more clearly.

Enter the Physical Workspace by clicking the tab in the upper left hand corner of the Workspace. It shows the connection between Central City and ISP City.

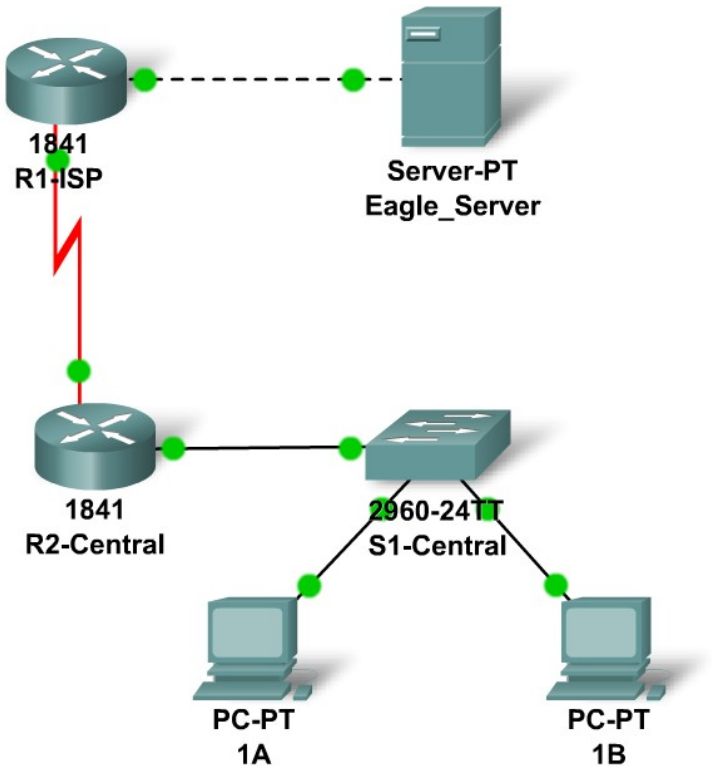
Step 2: View the standard lab setup at the various levels of the Physical Workspace.

Click on the Central City, it shows the city and the location of the Central Office building. Click on the Central Office building, it shows the floor plan of the building and the location of the Wiring Closet. Click on the Wiring Closet, it shows a physical representation of the equipment installed in the wiring closet and the cabling that connects the equipment. Examine this view of the topology.

Click on **Intercity** on the **Navigation** bar. Repeat the steps to view the equipment installed in ISP City.

9.9.1: Skills Integration Challenge-Switched Ethernet

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0	192.168.111.134	255.255.255.248	N/A
	S0/0/0	192.168.111.138	255.255.255.252	N/A
R2-Central	Fa0/0			N/A
	S0/0/0	192.168.111.137	255.255.255.252	192.168.111.138
PC 1A	NIC			
PC 1B	NIC			
Eagle Server	NIC	192.168.111.133	255.255.255.248	192.168.111.134

Learning Objectives

Upon completion of this lab, you will be able to:

- Determine IP subnet planning.
- Repair Ethernet-related network issues.
- Test the network.

Background

You have been asked to repair some problems in the network model related to the Ethernet LAN connected to R2-Central.

Task 1: IP Subnet Planning.

You have been given an IP address block of 192.168.111.0 /24. You must provide for the three existing networks.

Subnet assignments are:

- 1st subnet, existing student LAN, up to 100 hosts; (Fa0/0 on R2-Central)
- 2nd subnet, existing ISP LAN, up to 5 hosts; (already configured)
- 3rd subnet, existing WAN, point-to-point link; (already configured)

Interface IP addresses:

- The server, R1-ISP, and R2-Central's serial interface have already been configured.
- For R2-Central's Fa0/0 interface, use the highest usable address on the existing student LAN subnet.
- For hosts 1A and 1B, use the first 2 IP addresses (two lowest usable addresses) on the existing student LAN subnet.
- For Hosts 1A and 1B, the DNS server is 192.168.111.133 /29.
- The next hop router (to which the default route should point), R1-ISP, has an IP address of 192.168.111.138 /30.

Task 2: Repair Problems with the Ethernet Switched LAN.

- PC 1B has a wireless card and cannot be connected to the switch; add the Fast Ethernet Interface card PT-HOST-NM-1CFE to PC 1B.
- Connect this newly installed Fast Ethernet NIC to the Fa0/2 interface on the switch.
- Connect PC 1A to the Fa0/1 interface on the switch.
- Connect the Fa0/24 interface on the switch to the R2-Central Fa0/0 interface.

Apparently the Ethernet speed and duplex settings for the R2-Central Fa0/0 interface, the S1-Central switch interfaces (Fa0/1, Fa0/2, and Fa0/24), and the PC 1A interfaces are incorrect. Set all Ethernet interfaces to auto negotiate speed and duplex (which will achieve Full Duplex, 100 Mbps operation, if both ends of the link can support it). For all devices, make sure the power is on to the device and to the interfaces (make sure the Ethernet interfaces are not shut down). Add IP addresses to the router Fa0/0 interface and the two PCs. Use the highest usable subnet address as the gateway and assign the two lowest usable addresses to the PCs. The static route on the R2-Central should be a default static route which points via R1-ISP's serial interface IP address. These procedures were explained in the Chapter 5 and 6 Skills Integration Challenges.

Task 3: Test the Network.

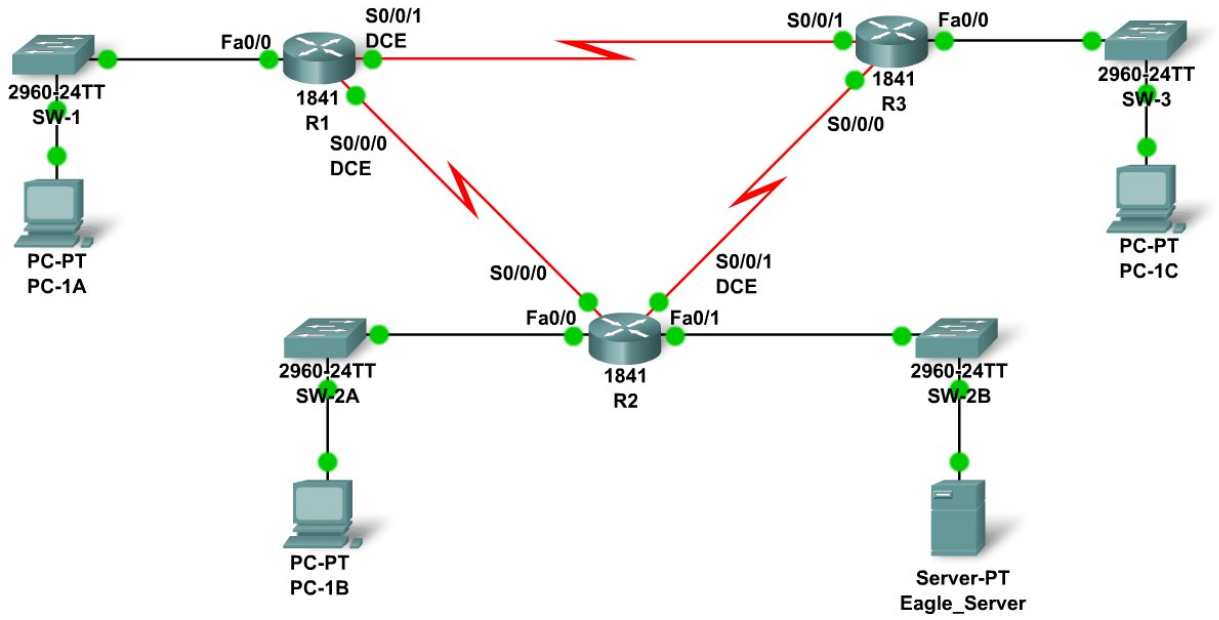
Use ping, trace, web traffic, and the **Inspect** tool to trace packet flow in simulation mode, with HTTP, DNS, TCP, UDP, ICMP, and ARP viewable, to test your understanding of how the network is operating.

Reflection

The two Layer 2 (and Layer 1 technologies) in this model are a serial connection (between the routers) and the Ethernet LANs (for the ISP server and with S1-Central switch). Compare and contrast the serial connection with Ethernet. In a future course you will learn much more about switched Ethernet technologies.

10.7.1: Skills Integration Challenge-Network Planning and Interface Configuration

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0			N/A
	S0/0/0			N/A
	S0/0/1			N/A
R2	Fa0/0			N/A
	Fa0/1			N/A
	S0/0/0			N/A
	S0/0/1			N/A
R3	Fa0/0			N/A
	S0/0/0			N/A
	S0/0/1			N/A
PC-1A	NIC			
PC-1B	NIC			
PC-1C	NIC			
Eagle_Server	NIC			

Learning Objectives

Upon completion of this lab, you will be able to:

- Build the network topology
- Plan the IP addresses
- Configure router and PC interfaces
- Test the network

Background

Practice your network building, planning, and configuration skills. Device names and routing have already been configured.

Task 1: Build the Network Topology.

Use the following charts, and the devices in the Device Pool, to create the topology.

Routers:

Hostname	Interface	Connects To	Interface
R1	Fa0/0	SW-1	Fa0/1
R1	S0/0/0 (DCE)	R2	S0/0/0
R1	S0/0/1 (DCE)	R3	S0/0/1
R2	Fa0/0	SW-2A	Fa0/1
R2	S0/0/1 (DCE)	R3	S0/0/0
R2	Fa0/1	SW-2B	Fa0/1
R3	Fa0/0	SW-3	Fa0/1

Switches:

Hostname	Interface	Connects To	Interface
SW-1	Fa0/2	PC-1A	FastEthernet
SW-2A	Fa0/2	PC-1B	FastEthernet
SW-2B	Fa0/2	Eagle_Server	FastEthernet
SW-3	Fa0/2	PC-1C	FastEthernet

Task 2: Create and Assign an Addressing Scheme.

You are asked to use the 192.168.1.0 /24 address space. Seven total networks are required; assign the networks in decreasing order of number of hosts required for efficient use of address space. Use the following charts to create an effective addressing scheme:

LAN:

Hostname	Interface	Number of Hosts
R1	Fa0/0	60
R2	Fa0/0	10
	Fa0/1	25
R3	Fa0/0	7

WAN:

Hostname	Address to be Assigned	Number of Hosts
R1-R2	R1-First host address	2
R1-R3	R1-First host address	2
R2-R3	R2-First host address	2

Use the following rules to assign the IP addresses.

- PC's will use the first host address in the subnet.
- Tthe server will use the second to last host address in its subnet.
- All FastEthernet ports on a router will use the last host address of the assigned subnet.
- The R1-R2 link will use the first WAN subnet, with R1 using the first usable address and R2 using the last usable adress.
- The R1-R3 link will use the second WAN subnet, with R1 using the first usable address and R3 using the last usable address.
- The R2-R3 link will use the third WAN subnet, with R2 using the first usable address and R3 using the last usable address.
- DCE interfaces should have clock rates of 56000.

Task 3: Interface Configuration

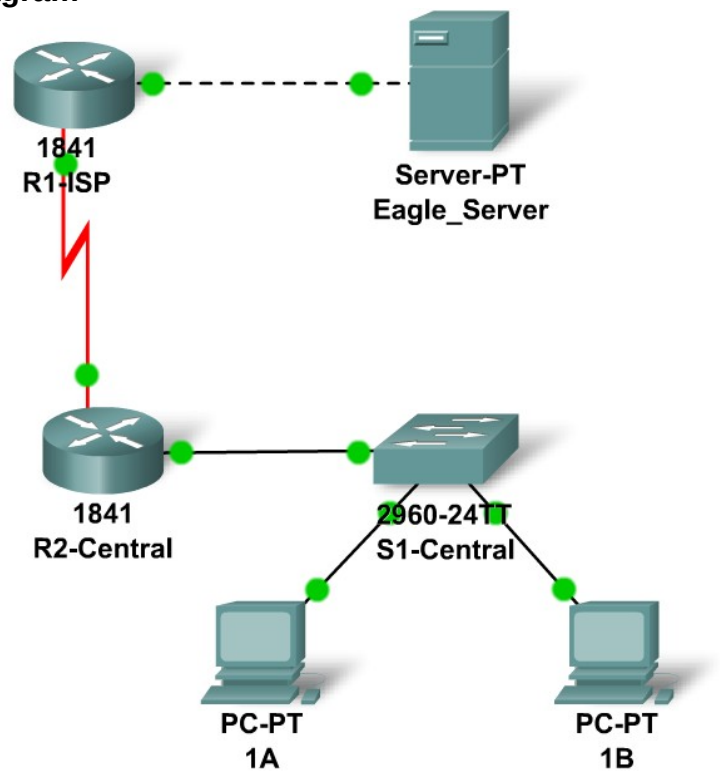
Perform interface configuration of the R1, R2, and R3 routers, the PCs, and the server according to the addressing scheme above.

Task 4: Testing Connectivity

Make sure all PCs can ping their gateways, other PCs, and the server.

11.6.1: Skills Integration Challenge-Configuring and Testing the Lab Network

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	Fa0/0			N/A
	S0/0/0			N/A
R2-Central	Fa0/0			N/A
	S0/0/0			N/A
PC 1A	NIC			
PC 1B	NIC			
Eagle Server	NIC			

Learning Objectives

- Build, test, and configure the entire lab network
- Integrate skills from throughout the course
- Analyze the events involved in requesting a web page (DNS, ARP, HTTP, TCP, IP, Ethernet, HDLC)
- Analyze the events involved in tracing the route to the web server (DNS, UDP, ARP, ICMP, IP, Ethernet, HDLC)

Background

Throughout the course, you have been developing network planning, building, configuring, and testing skills. You have also developed conceptual understandings of networking protocols and device algorithms. Here is an opportunity to test yourself: see if you can complete the entire challenge (approximately 100 configurable components, though some are quite easy) in under 30 minutes.

Task 1: Plan.

Use the standard Exploration lab topology as you plan your IP addressing scheme:

- Two 1841 routers with WIC-2T interface cards, installed in the right hand slot (one named R1-ISP, which has the serial DCE WAN connection to R2-Central, and the Fa0/0 LAN connection to Eagle_Server) and one named R2-Central (which has the serial DCE WAN connection to R1-ISP and the Fa0/0 LAN connection to S1-Central)
- One 2960TT Switch (S1-Central)
- Two PCs named 1A and 1B
- A server named Eagle_Server.

Note that both the Display names AND host names for all devices must be configured exactly, and in general all strings (names, passwords, banners) should be typed exactly as specified in these instructions, for the grading to work properly.

You have been given an IP address block of 192.168.3.0 /24. You must provide for existing networks as well as future growth.

Subnet assignments are:

- 1st subnet, existing student LAN, up to 28 hosts (Fa0/0 on R2-Central, connected to Fa0/24 on S1-Central)
- 2nd subnet, future student LAN, up to 28 hosts (not yet implemented)
- 3rd subnet, existing ISP LAN, up to 14 hosts (Fa0/0 on R1-ISP)
- 4th subnet, future ISP LAN, up to 7 hosts (not yet implemented)
- 5th subnet, existing WAN, point-to-point link (S0/0/0 on R1-ISP and S0/0/0 on R2-Central)

IP address assignments are:

- For the server, configure the second highest usable IP address on the ISP LAN subnet.
- For R1-ISP's Fa0/0 interface, configure the highest usable IP address on the ISP LAN subnet.
- For R1-ISP's S0/0/0 interface, configure the highest usable address on the existing WAN subnet.
- For R2-Central's S0/0/0 interface, use the lowest usable address on the existing WAN subnet.
- For R2-Central's Fa0/0 interface, use the highest usable address on the existing student LAN subnet and connect it to the Fa0/24 interface on S1-Central.
- For hosts 1A and 1B, use the first 2 IP addresses (two lowest usable addresses) on the existing student LAN subnet and connect them to the Fa0/1 and Fa0/2 interfaces on S1-Central.
- For the switch management interface, use the second highest usable address on the student subnet.

Task 2: Build and Configure the Network.

Build the network, taking care to make connections as specified. Configure both routers, the switch, the server, and the two PCs.

Configure the routers using the CLI to practice your skills. The router configuration must include "housekeeping" (display name, hostname, passwords, banner), interfaces (Fast Ethernet and Serial), and routing (static route on R1-ISP, default route on R2-Central). The following login passwords should all be set to "cisco" (no quotes): enable password (not secret), console, and Telnet. The banners should say **This is lab router R1-ISP. Authorized access only.** and **This is lab router R2-Central. Authorized access only.**

The interfaces should be configured as specified in the IP addressing section above; use a clock rate of 64000 on the R1-ISP S0/0/0 interface. The static route on R1-ISP should point to the existing Student LAN subnet via R2-Central's serial interface IP address; the static route on R2-Central should be a default static route which points via R1-ISP's serial interface IP address. Whenever you configure a Cisco IOS device, be sure to save your configuration.

On the switch, configure the display name, hostname, banner (**This is lab switch S1-Central. Authorized access only.**), login passwords for access (enable, console, and Telnet passwords all set to "cisco"), and management interface (int vlan1). Whenever you configure a Cisco IOS device, be sure to save your configuration.

For Hosts 1A and 1B, in addition to IP configuration, configure them to use DNS services. For the server, enable DNS services, use the domain name eagle-server.example.com, and enable HTTP services.

As you work, use "Check Results" to see what components still need to be configured. If you want more practice, use "Reset Activity" and re-time yourself doing the entire configuration again.

Task 3: Test and Analyze.

It is a good practice to test connectivity through ping and Telnet, and to examine routing tables. Once you are convinced your network is working, make sure you have saved your configurations on the Cisco IOS devices. Then power cycle the devices, and reset the network. In simulation mode, request a web page while making the following protocols visible in the event list: DNS, HTTP, Telnet, TCP, UDP, ICMP, ARP. Examine the packets as they are processed by the devices to study protocol behavior, especially how IP is involved in everything. Also note the algorithms used by hosts, switches, and routers. Explain the entire process to a peer. Power cycle the devices to clear the network again, and, also in simulation mode, issue a traceroute to the server from one of the PCs. Examine how trace is built up of ICMP echo requests. Again explain the entire process to a peer.

Task 4: Reflection - Putting it All Together.

Relate the processes observed in Task 3 to the TCP/IP Protocol Graph. Your skills at modeling networks in Packet Tracer will serve you well in subsequent courses.

